lower section 20. The reaction chamber has outer diameters ranging from ¾ inch to 4 inches.

An axially extending radiant burner 7 is vertically disposed along the central axis of the helical coil section 20 of the tubular reaction conduit. The radiant burner is supported by a burner gas conduit 12 that conveys a mixture of fuel and oxidant from the inlet means 8 to the radiant burner. In this embodiment, the radiant burner 7 comprises a gas permeable metal fiber zone 14 that subtends the entire circumference of the radiant burner. Fuel and oxidant pass through the permeable metal fiber zone 14 where they are ignited on the surface, thereby combusting and releasing heat to form an incandescent zone that radiates energy in a predominantly uniform radial direction. The helical tubular reaction chamber and catalyst therein are sized for creation of mass velocities ranging from 400 $lb/ft^2/h$ to 1500 $lb/ft^2/h$. The catalyst in the helical tubular reaction chamber has average catalyst particle diameters ranging from ¼ to 1 inch for producing gas pressure drops ranging from 1 psi to 8 psi during flow through the reaction chamber. The helical tubular reaction chamber has gas exit end temperature ranging from 1150°F to 1400°F, when heated by said radiant burner, in operation. The helical tubular reaction chamber has maximum tube wall

temperatures ranging from 1300°F to 1600°F, when heated by said radiant burner, in operation. The helical tubular reaction chamber has average heat fluxes ranging from 3,000 btu/ft^2/h to 10,000 btu/ft^2/h, when heated by said radiant burner in operation. The helical tubular reaction chamber is sized to have capacity to generate hydrogen plus carbon monoxide product in volumetric quantities ranging from 50 SCFH to between 100 and 1500 SCFH. The radiant burner comprises a supported metal fiber material consisting essentially of an alloy containing principally iron, chromium, and aluminum and smaller quantities of yttrium, silicon, and manganese, said alloy having extended life at operating temperatures up to 2000°F. The radiant burner has surface temperatures ranging between 1500°F and 1900°F, in operation. The radiant burner has an operating combustion intensity typically ranging from 150,000 btu/ft^2/h to 350,000 btu/ft^2/hr, wherein the combustion intensity is defined as the higher heating value of the fuel combusted divided by the permeable radiant burner surface area. The radiant burner has an operating excess air ratio typically ranging from 30% to 100%, wherein the excess air ratio is defined as percent combustion air in excess of the stoichiometric amount required for complete combustion of the burner fuel. The helical coil has free area in

the range 50% to 75%, wherein the free area is defined as the ratio of the free area between successive coil turns and the cylinder that bisects the helical coil circle.

In Figs. 1, 3 and 4, a gas conditioning system 101 and fuel cells 100 to receive hydrogen are in operative communication with reactor outlets 3.

Fig. 5 depicts yet another embodiment of the present invention. In this embodiment shown schematically the reaction chamber 116 is defined by the annular space between an outer conduit 131 and an inner conduit 132. The reactant gases enter the reaction chamber through inlet means 112, and pass through catalyst bed at 116 and then to space 134 at the inlet of the inner conduit 132. The reactant gases exit the inner conduit space through exit means 113. The reactant gases passing through the inner conduit 132 transfer heat to the reactant gases contained in the reaction chamber 116 to beneficially recuperate heat from the endothermic reaction.

An axially extending radiant burner 107 is vertically disposed within a combustion chamber 104. The radiant burner is oriented in parallel with the longitudinal extent of the tubular reaction conduit. If a multiplicity of such tubular reaction conduits are used, they can be oriented concentrically around a